



STS-114 (LF1) ISS Contingency Shuttle Crew Support (CSCS) Capability

Flight Readiness Review

June 29-30, 2005

**Steve Huning/OC
Dave Williams/EC6**

Oxygen Status

- **Elektron is having problems (primary device for supplying oxygen to ISS)**
 - **Liquid Unit #5**
 - Unable to maintain pressure in the pressurized part of the Elektron – unit is considered FAILED
 - **Liquid Unit #6**
 - Unit indicated high cell stack current – unit is considered FAILED
 - **Liquid Unit #7**
 - Potassium Hydroxide (KOH) contamination found in the Hydrogen (H₂) vent line
 - Liquid Unit #7 is suspected cause of contamination – unit recovery is being attempted
- **Recovery Plan for Liquid Unit #7:**
 - Russians launched hardware and aerosol filters on 15P to route Elektron H₂ vent to the BMP (Russian trace contaminant control subsystem) overboard vent since Elektron vent was blocked by KOH
 - Russians launched additional KOH and aerosol filters on 18P
 - The additional aerosol filters were installed to protect the BMP vent from KOH contamination
 - Russians were able to transfer some KOH from Liquid Unit #5 to #7
 - Unit #7 did also exhibit a small nitrogen leak. But, at the last operation, it was acceptable.
 - More troubleshooting in work by RSC-E

Oxygen Status (Cont'd)

- **Progress**
 - 18P was modified to carry 110 kg (242 lbm) of oxygen (O₂)
 - As of 27 June – 101 kg (223 lbm) of O₂ left
- **TGK/SFOG:**
 - As of 27-June
 - 40 old design candles. Using the older candles first
 - 15 of 66 candles attempted have failed which is a 22.7% failure rate
 - Russians predicted a 20% failure rate
 - 72 new design candles onboard
 - New design is yellow tagged. Hazard Report and CIL needs to be updated to remove the yellow tag.

CDRA Status

- **Carbon Dioxide Removal Assembly (CDRA) has operated successfully in at least single bed mode and sometimes in dual bed mode (except for the two stage pump failure and the two Air Selector Valve (ASV) failures which were corrected)**
- **Most of the CDRA failures to date are due to a poor desiccant/adsorbent material containment design**
 - Air sock filters have been installed to protect the two stage pump, the blower/precooler, and 5 of the 6 CDRA ASVs
 - Four spare ASVs are on-orbit to protect CDRA operation
 - Have removed the CDRA material from the CDRA bed check valves by running in single bed mode
 - Have a draft plan on how to remove a check valve and have the crew clean it on-orbit
- **Launching on LF1 the following CDRA spares to support Contingency Shuttle Crew Support (CSCS):**
 - Blower/Precooler Orbital Replacement Unit (ORU)
 - Heater Controller
 - Pump/Motor Controller
 - Two Stage Pump ORU
- **CDRA precooler has a similar corrosion/design issue as the Extravehicular Activity (EVA) Service and Performance Checkout Unit (SPCU) Heat Exchanger**
 - Plan is in place to replace the precooler with the spare launched on LF1 prior to predicted end of life
- **The CDRA Blower Shutdown on GMT 111 (April '05)**
 - The Command and Data Handling (C&DH) team has traced the last failure to a check sum failure due to a timing issue between the Multiplexer/Demultiplexer (MDM) and the CDRA Controllers as commands are issued by the LA3 MDM on the local 1553 bus
 - Timing issue can be cleared by rebooting the LA3 MDM

CSCS Duration Capability General Assumptions

- **July 13 LF1 launch date**
- **ISS actual consumables on 6/3 were utilized as starting point for this report**
- **19 Progress assumed unavailable during CSCS duration**
- **Shuttle will remain docked to ISS for 17 days and will provide:**
 - **Water and waste management for its 7 crew**
 - **Oxygen for all 9 crew**
 - **ISS and Shuttle (expired US LiOH on ISS) will provide CO2 removal during this time**
- **All needed Orbiter consumables (water, food, etc) will be transferred, as well as all hardware launched in the MPLM**
- **EVA**s
 - **One nominal EVA from Orbiter A/L**
 - **One tile repair EVA from ISS A/L [Shuttle undocked for 48 hours, with 3 crew on-board]**
 - **One inspection EVA from ISS A/L [Orbiter remains docked to ISS]**
- **Total CSCS crew is nine (two female, seven male). No crew will return in the Soyuz.**
- **ISS resources are run to zero**

LF1 CSCS Summary report (as of 6/3/05)

O2 generation is most limiting consumable resulting in 56 days capability

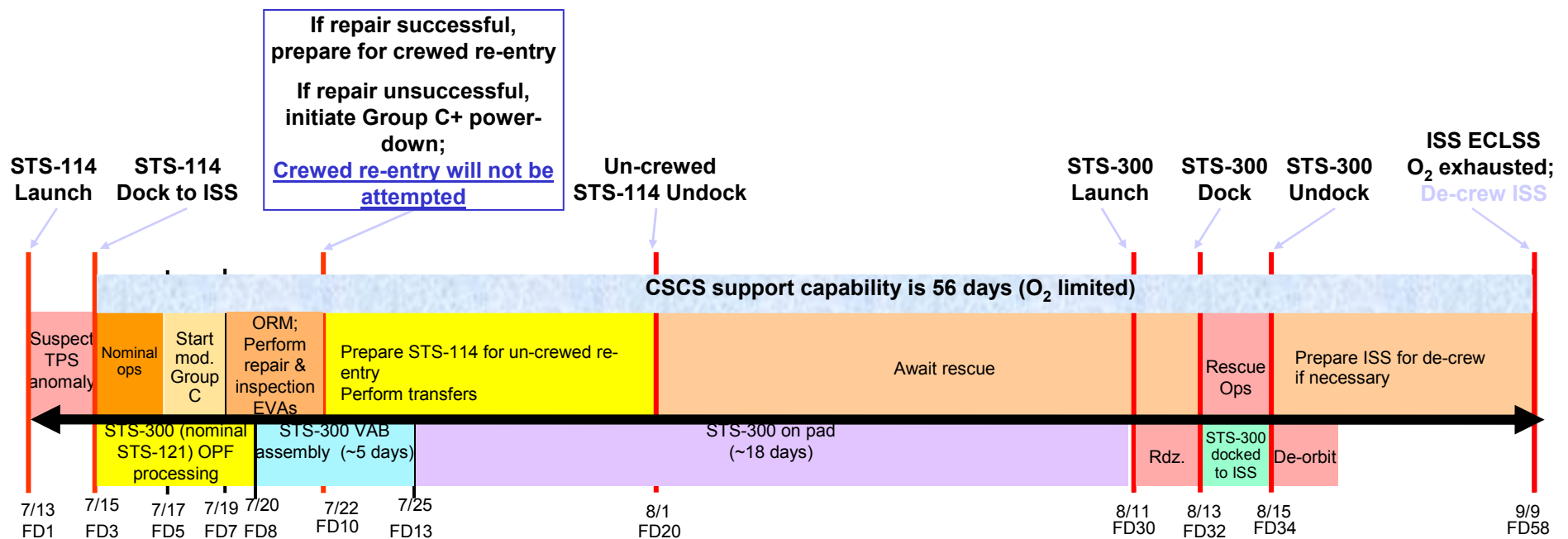
Dual bed CDRA fail is most limiting failure case resulting in 30 days CO2 removal capability

CSCS TPS Duration Report as of 6/3/05		
L-1 Month Report for LF-1, 9 Crew on ISS		
- Assumes STS launch date of: 7/13/2005 - Based on current projected ISS consumables and system health - Assumes CSCS TPS duration begins at STS dock - LON Rescue Flight Must Dock to ISS by: 9/09/2005		
ISS Failure @ MECO	Engineering Estimate	No ISS Failures
30 Days (CO2 Removal)	56 Days (O2 Generation)	71 Days (Waste Mgmt)
O2 Generation		
Total ISS O2 at dock: 314.12 kg	Total ISS O2 at dock: 314.12 kg	Total ISS O2 at dock: 357.75 kg
Progress O2 tanks: 64.8 kg	Progress O2 tanks: 64.8 kg	Progress O2 tanks: 108.42 kg
80% Old SFOG: 30 cartridges	80% Old SFOG: 30 cartridges	80% Old SFOG: 30 cartridges
New SFOG: 72 cartridges	New SFOG: 72 cartridges	New SFOG: 72 cartridges
A/L tanks: 165.56 kg	A/L tanks: 165.56 kg	A/L tanks: 165.56 kg
Elektron: FAILED since 3/05	Elektron: FAILED since 3/05	Elektron: ON-3 crew
STS O2 Xfer: 0 kg	STS O2 Xfer: 0 kg	STS O2 Xfer: 0 kg
EVA O2 Used (ISS): 14.05 kg	EVA O2 Used (ISS): 14.05 kg	EVA O2 Used (ISS): 14.05 kg
Total Days: 39+17(STS) = 56 Days	Total Days: 39+17(STS) = 56 Days	Total Days: 68+17(STS) = 85 Days
CO2 Removal		
STS LiOH: 42 cans	STS LiOH: 42 cans	STS LiOH: 42 cans
ISS Good LiOH: 0 cans	ISS Good LiOH: 0 cans	ISS Good LiOH: 0 cans
ISS Expired LiOH: 30 cans	ISS Expired LiOH: 30 cans	ISS Expired LiOH: 30 cans
RS LiOH: 18 cans	RS LiOH: 18 cans	RS LiOH: 18 cans
Vozdukh: ON-3 crew	Vozdukh: ON-3 crew	Vozdukh: ON-3 crew
CDRA: FAILED	CDRA: Single Bed (5 crew)	CDRA: Dual Bed (8 crew)
Total Days: 30 Days	Total Days: 102 Days*	Total Days: Unlimited Days
Water		
ISS H2O: 654 L	ISS H2O: 654 L	ISS H2O: 654 L
STS H2O Xfer: 1032 L	STS H2O Xfer: 1032 L	STS H2O Xfer: 1032 L
Leaky CWCs: 8 CWCs	Leaky CWCs: 0 CWCs	Leaky CWCs: 0 CWCs
CFU: ON	CFU: OFF	CFU: ON
SRV-K: ON	SRV-K: ON	SRV-K: ON
Total Days: 51+17(STS) = 68 Days	Total Days: 66+17(STS) = 83 Days*	Total Days: 64+17(STS) = 81 Days
Waste Management		
Solid Waste	ASU: 35.1 Days	
	Back-Up Hardware: 19.5 Days	
	Total Days: 54.6 + 17 (STS) = 71.6 Days	
Liquid Waste	ASU: 53.5 Days	
	Back-Up Hardware: 2.3 Days	
	Total Days: 55.8 + 17 (STS) = 72.8 Days	
Food		
Total Rations: 479 rations	Total Rations: 479 rations	Total Rations: 479 rations
Caloric Intake: 2400 kcal/day	Caloric Intake: 2000 kcal/day	Caloric Intake: 2000/1000 kcal/day
Total Days: 56 Days	Total Days: 66 Days	Total Days: 108 Days

LF1 CSCS Scenario Overview

Durations from STS-114 dock:

- ISS CSCS capability **56 days** (O₂ limited)
- Shuttle LON **29 days** (27 days to launch + 2 days to dock)





STS-114 Flight Readiness Review (FRR)

International Space Station Program (ISS)

Increment 11 & Logistics Flight 1 (LF1)

June 29, 2005



International Space Station (ISS) Program Increment 11 & Logistics Flight 1 (LF1) Agenda



- Contingency Shuttle Crew Support
- Increment 11 Flight and Stage Overview
- On-orbit Stowage before and after LF1
- ISS Consumables Status On-orbit Capability For 2 Crew
- ISS LF1 / STS 114 Flight Priorities Overview
- LF1 STS114 Launch Package Cargo Elements
- External Stowage Platform Attachment Device (ESPAD) status
- On-orbit ISS Vehicle Status
- Readiness Statement

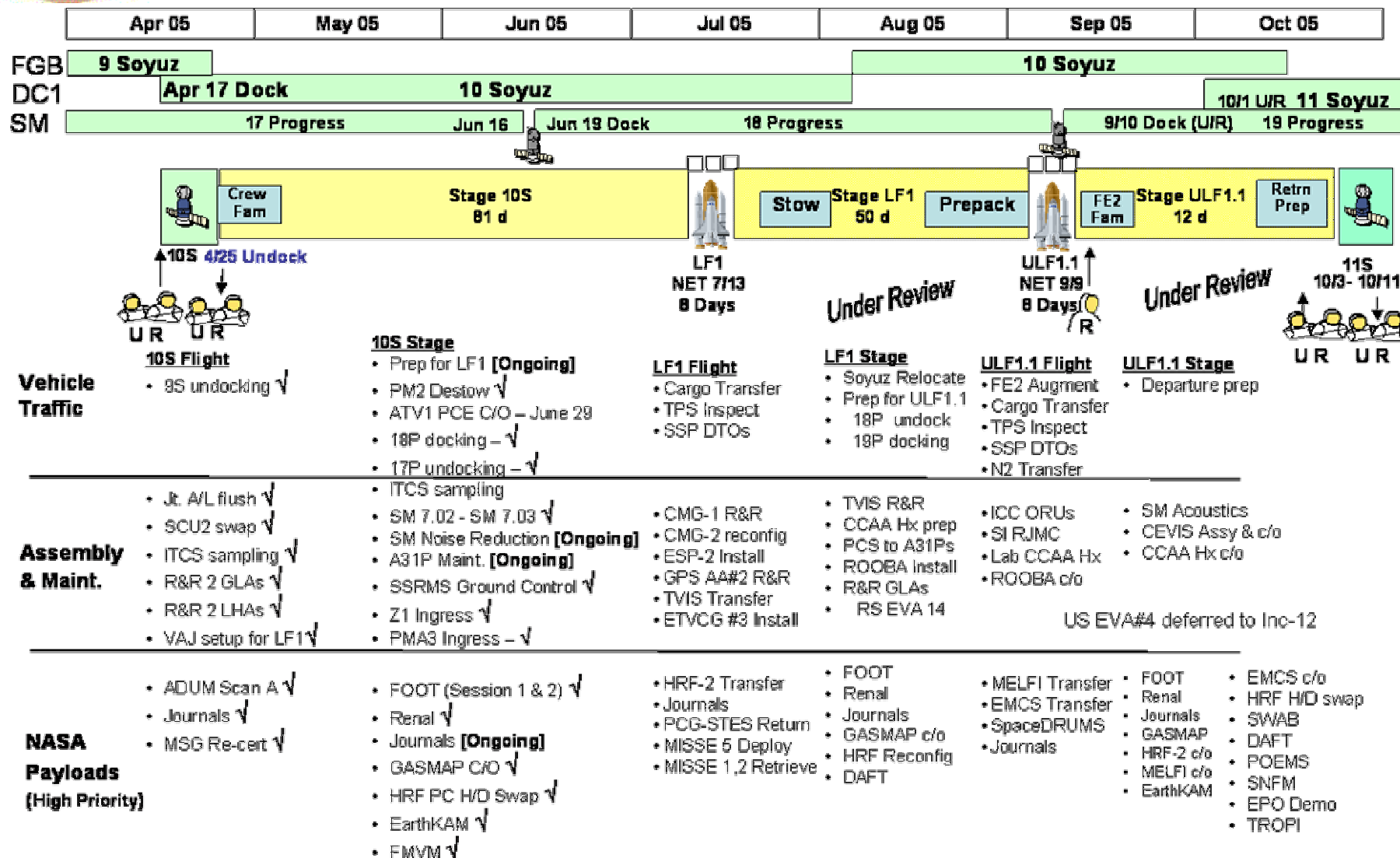
S. Huning &
D. Williams
F. Booker

C. Hansen
S. McGrath
F. Booker





Increment 11 Overview June 27, 2005



OC/F. Booker



On-Orbit Stowage Before and After LF1



Pre-packed items waiting for return on LF1

- ~36 CTBE of pre-packed hardware stowed in Node and Lab racks
- ~40 CTBE of pre-packed hardware stowed on FGB floor

MPLM is returning more hardware than is being launched

- Current assessment results in a net improvement to on-orbit stowage of ~38 CTBE

Russians have stated they cannot move their hardware from the USOS to the RS, however other stowage mitigation activities are projected to offset this development

- Use of PMA3 for stowage
- Allowing Russian hardware delivered on 18P to remain in Progress
- Increased trash disposal on 17P

On-orbit stowage is projected to be slightly over the Operational Stowage Target at LF1 departure



ISS Consumables Status On-orbit Capability For 2 Crew (June 21, 2005)

Current On-Orbit Capability			Projected On-Orbit Capability with LF1	
Consumable	Date to Skip Cycle	Date to zero supplies	Date to Skip Cycle	Date to zero supplies
Food	October 6, 2005	November 20, 2005	December 5, 2005	January 19, 2006
Total Water**	October 4, 2005	November 18, 2005	March 2, 2006	April 16, 2006
O ₂ if no Elektron*	November 25, 2005	January 9, 2006	December 3, 2005	January 17, 2006
EDV	February 12, 2006	March 29, 2006	February 12, 2006	March 29, 2006
KTO (Solid Waste Container)	January 28, 2006	March 14, 2006	January 28, 2006	March 14, 2006
LiOH #	November 5, 2006	December 31, 2006	November 5, 2006	December 31, 2006
Filter Inserts	September 4, 2006	October 19, 2006	September 4, 2006	October 19, 2006
Toilet Inserts	September 25, 2006	November 9, 2006	September 25, 2006	November 9, 2006

Date based on expiration of on-orbit LiOH, no projected LiOH use. 14 days LiOH from 11/6/06 to 12/31/06

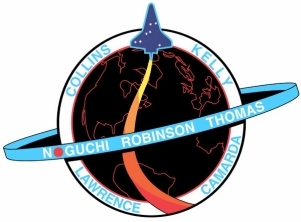
** Assumes 1.5 L/day/person- no Elektron until 18P, 2.3 L/day/person after 18P.

* Skip cycle does not protect for module repress, contingency EVA or CHeCS/RSP support

^ Assuming 80% reliability factor applied to old SFOGs and 72 new SFOGs are included

* With 18P and LF1, no other vehicles' dates provided assume that LF1 will provide O₂ to the ISS crew for the docked duration. The current LF1 plan is also to 'pump up' the ISS ppO₂ prior to departure, but that is not included in the O₂ chart because it does not matter with 19P launch at the end of August.

OC/F. Booker



ISS LF1 / STS 114

Flight Priorities Overview



Inspect all Orbiter Reinforced Carbon Carbon (RCC) and tile, downlink sensor data and digital photos

EVA1: Thermal Protection System Detailed Test Objective-848 (Emittance Wash Applicator (EWA), Non-Oxide Adhesive eXperiment (NOAX), and tile board Orbiter Boom Sensor System (OBSS) scan), Global Position System (GPS) antenna #2 R&R, External Stowage Platform2 (ESP2) and Control Moment Gyro-1 (CMG-1) get ahead tasks

EVA2: CMG-1 Remove & Replace

EVA3: External Television Camera Group (ETVCG), ESP2, & Materials International Space Station Experiment 5 (MISSE 5) install; MISSEs 1 and 2 retrieve; ESP2 Fixed Removable Grapple Fixture (FRGF) retrieve

Multi Purpose Logistics Module (MPLM) install and retrieve with Space Station Robotic Manipulator System (SSRMS)

Logistics transfer to/from the MPLM and Orbiter middeck

- **Sixteen Contingency Water Containers (CWC) of water to ISS**
- **Restore ISS Joint Air Lock capability, transfer 2 Extravehicular Maneuvering Units (EMU) from middeck to ISS**
- **Cargo to/from seven Resupply Stowage Platforms (RSPs) and four Resupply Stowage Racks (RSRs) in MPLM**
- **Human Research Facility-2 (HRF-2) rack from MPLM to ISS Lab**
- **Return one powered Protein Crystal Growth-Single Thermal Enclosure System (PCG-STES10) from ISS to middeck**
- **Nitrogen transfer to ISS tanks**

Photo survey of ISS after undocking



LF1 STS114 Launch Package Cargo Element Summary



- ✓ **Raffaello Multi-Purpose Logistics Module (MPLM)**
 - CoFr Manifest Baseline CR9317 (04/14/05)
 - 80 Cargo Transfer Bag Equivalents (CTBEs), (2250 lbs, ascent)
 - HRF-2 to lab (1700 lbs), ascent
 - 142 CTBEs, (5450 lbs), return

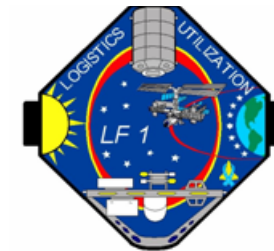
- ✓ **Light Weight MPESS Carrier (LMC)**
 - Control Momentum Gyro (CMG)
 - Thermal Protection System (TPS) Detailed Test Objective (DTO)

- ✓ **External Stowage Platform 2 (ESP2)**
 - Flex Hose Rotary Coupler (FHRC)
 - Utility Transfer Assembly (UTA)
 - Main Bus Switching Unit (MBSU)
 - Video Stanchion Support Assembly (VSSA)
 - EFRAM (EVA FRAM) without electrical connector
 - External Stowage Platform Attachment Device (ESPAD)

- ✓ **ISS Middeck Cargo**
 - 2 ISS EMUs, ascent & return
 - 1 KURs Return
 - 1 Powered Payload Return



LF1 STS114 Launch Package Cargo Element Summary



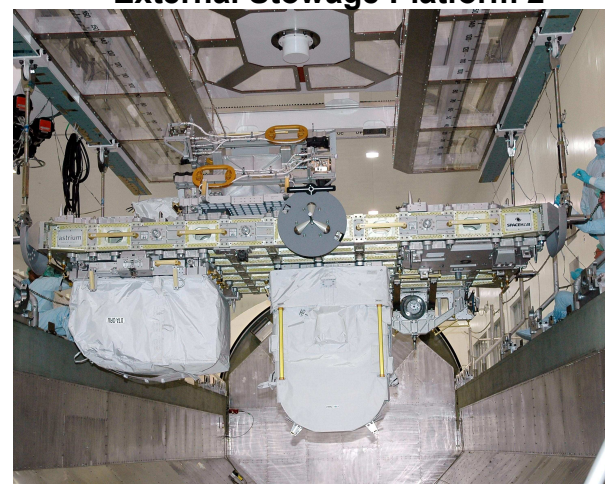
Multi-Purpose Logistics Module (MPLM)



**CMG & TPS DTO 848
Light Weight MPRESS Carrier (LMC)**



External Stowage Platform 2





LF1 Secondary Locking Feature Issue

LF1 FRR

Last Updated 6/27/05

Chris Hansen
NASA ISS Deputy System Manager – Structures and Mechanisms
281/244-5833



EUTAS Secondary Locking Feature Issue



A recent issue was discovered with the launch lock bolt of the Enhanced Universal Trunion Attach System (EUTAS) on the External Stowage Platform Attachment Device (ESPAD)

The launch lock bolt is a safety critical fastener that is required to have a “secondary” locking feature to prevent inadvertent back-out of the fastener during launch

The secondary locking feature is a prevailing-torque type locking feature that exhibited a low running torque during final installation that was not caught and corrected

Because running torque was low, the fastener cannot be guaranteed to remain in place during launch

- **Bolt is captive, so it does not present a FOD issue**

If the bolt backs out, the secondary EUTAS can become a 55 pound mass that is free to slide 0.76” within its housing, causing undetermined loads to the surrounding structure

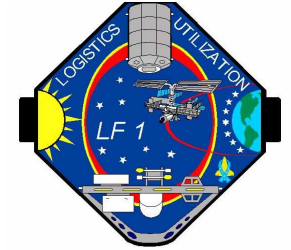
Correction of this problem on the launch pad is risky to ground personnel and presents a risk of damage to nearby hardware in the Payload Bay

The ISS program decided to pursue an analysis approach to prove that if the fastener backs out, the additional dynamic loads imparted to the hardware are acceptable

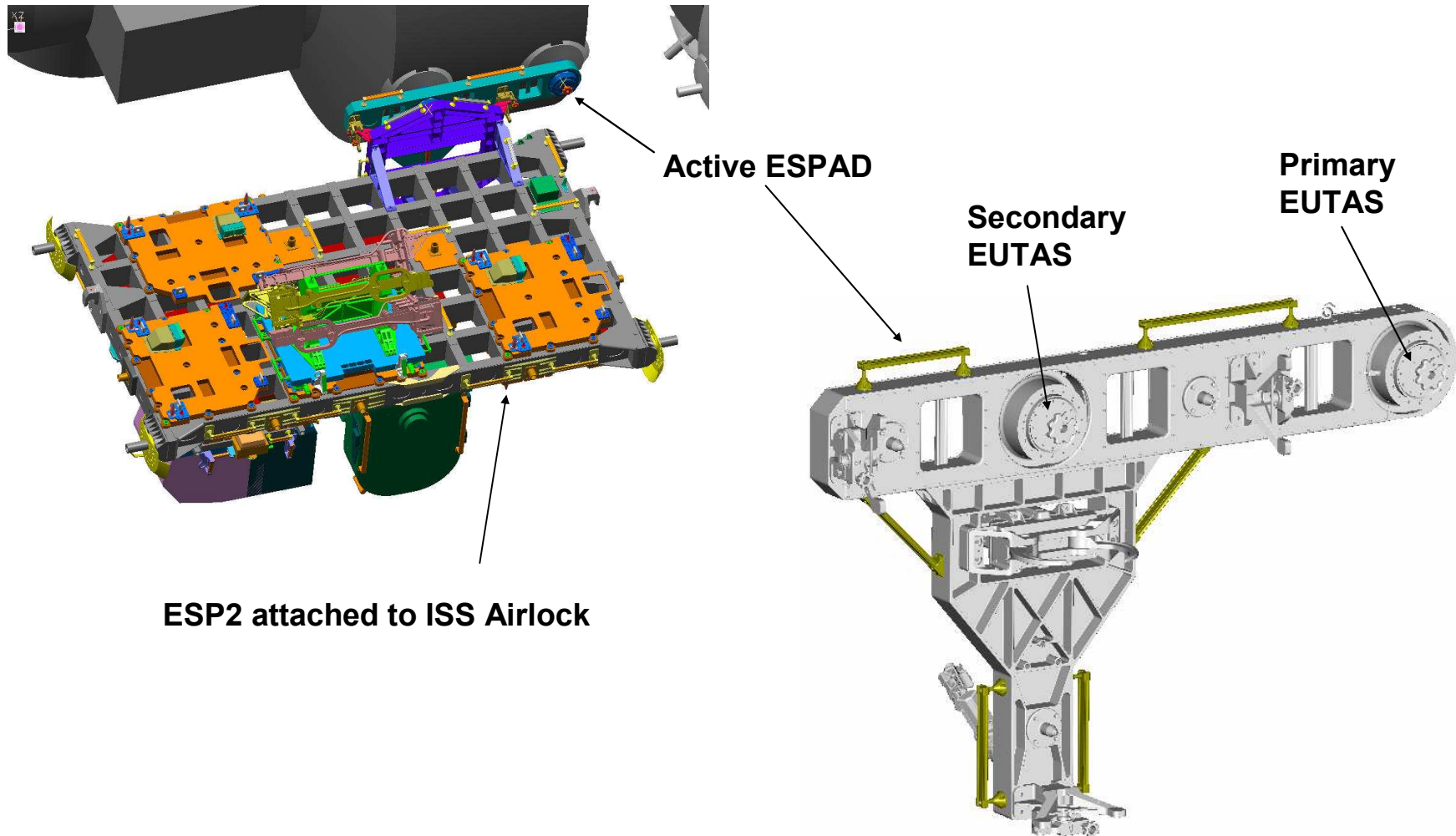
- **Non-linear dynamic analysis to determine impact loads generated when the free mass is subjected to launch environment**
- **Analysis to verify that 55 pound mass will remain contained within housing**
- **Verification that additional load increases, if significant, can be tolerated by all affected hardware by performing appropriate structural analysis**

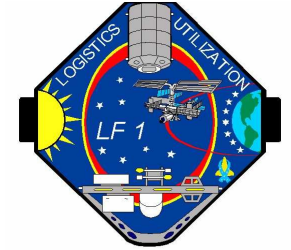
Preliminary schedule estimates are that analysis should be complete ~July 13th

Pursuing a repair option in parallel that can be implemented if analysis is unsuccessful



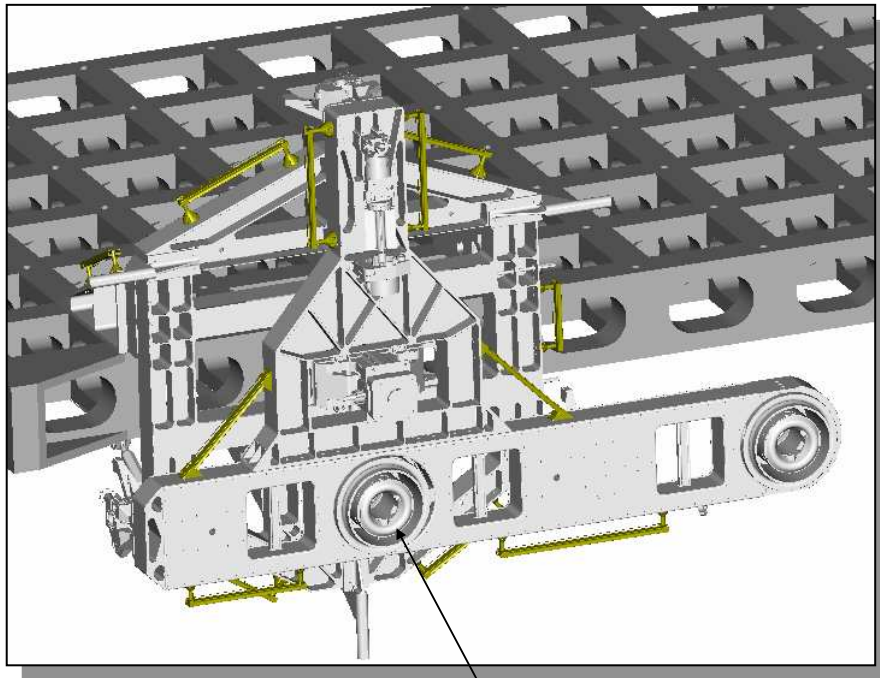
ESP-2 Configuration





ESPAD Overview

Launch Configuration

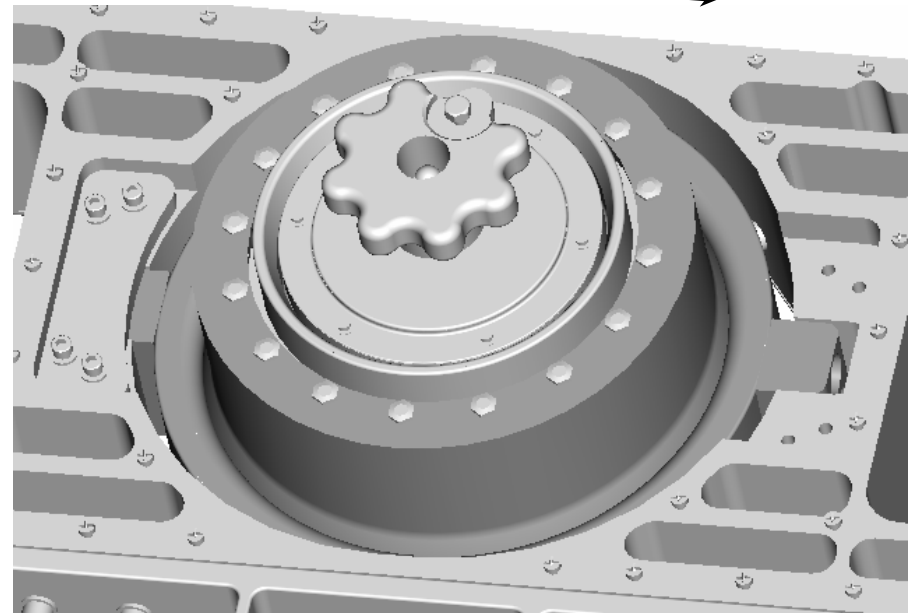


Secondary EUTAS

Secondary EUTAS

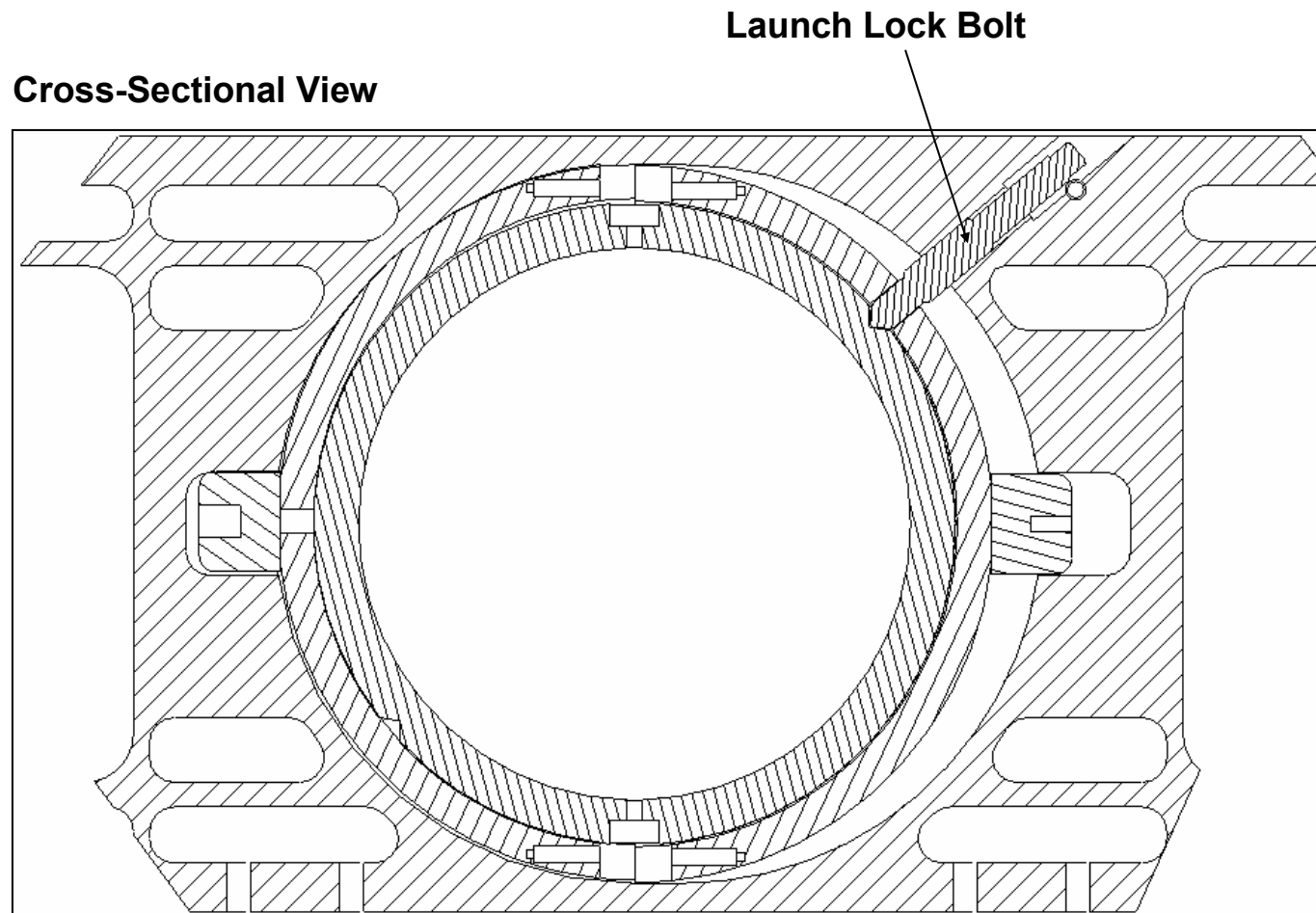
$\pm .38''$

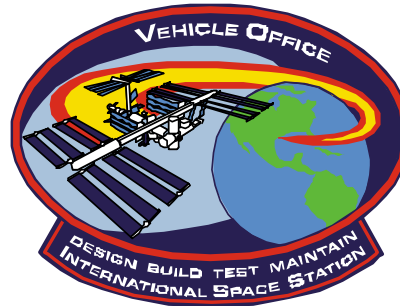
Translation after removal of launch lock





Secondary EUTAS





International Space Station Program (ISS)

On- Orbit Engineering Office

Steve McGrath, MER Manager

June 29, 2005



ISS Hardware Status



- The scope of the presentation includes recent ISS on-orbit hardware issues, as well as significant on-going issues from the past 2+ years.
- “Significant”: The ISS Program tracks and dispositions all anomalous events – the matrix of on-going hardware issues in the following charts is based on the relative impact of the anomaly to ISS mission operations and safety of flight.
- Although we are following the full matrix of issues from an ISS Program standpoint, the presentation today will concentrate on those issues directly affecting the joint LF1 mission.



ISS Hardware Status (Recent)

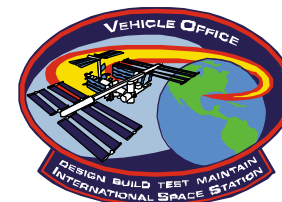


Issues	Impact to LF-1 Stage Operations	To be Presented
Elektron Status	Yes	Yes/CSCS Topic
Carbon Dioxide Removal Assembly (CDRA) Shutdown on GMT 111	Yes	Yes/CSCS Topic
Remote Power Controller Module (RPCM) MT3A A RPC 12 Trip	Yes	Yes
Beta Gimbal Assembly (BGA) Motor High Current (Stall on GMT 165)	Yes	Yes
Centerline Berthing Camera System (CBCS) Status	No	No



ISS Vehicle Status

(Ongoing)



Issues	Impact to LF-1 Stage Operations	To be Presented
Suspected EMU Coolant Loop Contamination	Yes	Yes/XA
Station Support Computer (SSC) Status	Yes	No
DCS 760 Camera Status	Yes	No
USOS Lighting Status	Yes	No
ISS Dynamic Coupling Events	Yes	No
Exercise Equipment	Yes	No
Control Moment Gyro (CMG) 1 Failure	Yes	No
RPCM S02B-D RPC 17 Trip/CMG2 Impacts	Yes	No
CMG3 Anomalous Signature	Yes	No
GPS Antenna 2 & 4 Low Signal/Noise	Yes	No



ISS Vehicle Status

(Ongoing, continued)



Issues	Impact to LF-1 Stage Operations	To be Presented
Volatile Organic Analyzer (VOA) Anomaly	Yes	No
Loop A Thermal Radiator Rotary Joint (TRRJ) Off-Nominal Behavior (Rotary Joint Motor Controller Failure)	Yes	No
Starboard Thermal Radiator (STR) Multiplexer / De-Multiplexer (MDM) Fail	Yes	No
Utility Outlet Panel (UOP) 4 RPCM Trip	Yes	No
P6 Battery Reconditioning	Yes	No
MDM Co-Therm Material Thickness (EXT & STR)	Yes	No
Verification Gas Assembly (VGA) Leak	Yes	No
P1-P3 Capture Latch Heater Failure	Yes	No
Quick Disconnect Torque Relaxation	Yes	No



ISS Vehicle Status

(Ongoing, continued)



Issues	Impact to LF-1 Stage Operations	To be Presented
SM Window 13 Status	No	No
Plasma Contactor Unit (PCU) 2 Latch Valve Fail	No	No
Internal Thermal Control System (ITCS) Coolant Quality	No	No
S1 Lower Outboard External TV Camera Group Anomalies	No	No
Defibrillator Current Sensor	No	No



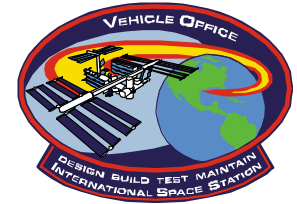
Remote Power Controller Module (RPCM) MT3A A RPC 12 Trip



- Observation
 - On GMT 2005/164:23:36:47 (13 June) RPCM MT3A A RPC 12, which provides power to the Mobile Transporter (MT) Load Transfer Unit Heater 2, tripped.
- Discussion:
 - Per procedure, ground teams performed a 50Hz data dump, cleared the trip, and set the RPC Close-Inhibit to ensure the RPC will not be inadvertently closed before data analysis supports re-closure.
 - This RPCM was removed and replaced on GMT 2003/097 during a planned stage EVA.
- Acceptable for Flight: Yes
 - There are no significant impacts. The RPC powers a set of four heaters on the Mobile Transporter. The heaters have a redundant set powered by MT4B A RPC 12, which remains functional. In addition, Integrated Motor Controller Assembly motors can be activated to provide thermal stability.
- Status:
 - Probable Field Effect Transistor (FET) driver hybrid issue. On-orbit data did not show any current spikes which would indicate an over-current trip.
 - On GMT 166 (15 June) an attempt to re-close the RPC was unsuccessful.
 - Full root cause analysis requires return of the RPCM – three suspected FET hybrid failed RPCMs are manifested for return on LF1.



Beta Gimbal Assembly Motor High Current



- Observation
 - On GMT 2005/165 18:48 (June 14), the 4B channel Beta Gimbal Assembly (BGA) experienced a stall and motor trip.
- Discussion:
 - Ground teams executed BGA stall/trip recovery procedures, back-driving the BGA and parking it for best power generation at 130 degrees.
 - BGAs have a known history of stalls and ground teams have implemented operational measures (BGA conditioning, attitude specific operational modes) to reduce their frequency.
 - The stall occurred on day 35 of a 42-day extended X-axis into the Velocity Vector (XVV) flight attitude period.
 - BGAs are more susceptible to stalls in XVV flight attitude.
 - The last stall on the 4B BGA was in December 2001 (October 2002 for the 2B BGA).
- Acceptable for Flight: Yes
 - Both BGAs have been operating nominally since the stall/recovery events on GMT 165.
- Status:
 - Data from the GMT 2005/165 stall and recovery were consistent with previous occurrences and not entirely unexpected given the extended XVV flight attitude period.
 - An operational strategy is in place to minimize the risk of BGA stalls.
 - During XVV flight attitudes, limit the sweep angle for solar arrays whenever possible.
 - During Y-axis into the Velocity Vector (YVV) flight attitudes, perform operational “conditioning” of BGAs.

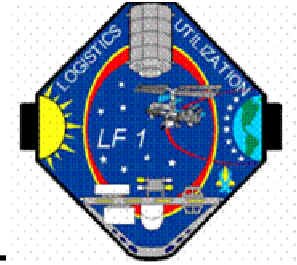


Readiness Summary

- The ISS Program is ready to proceed with the launch of ISS LF1/STS 114
- Flight objectives and priorities are defined
- Flight manifest has been defined
- Hardware has been or will be delivered and installed to support launch date
- Personnel and facilities are ready to support flight
- All open work and issues have been resolved or have an acceptable plan that will support July 13, 2005 launch



S&MA Open Paper



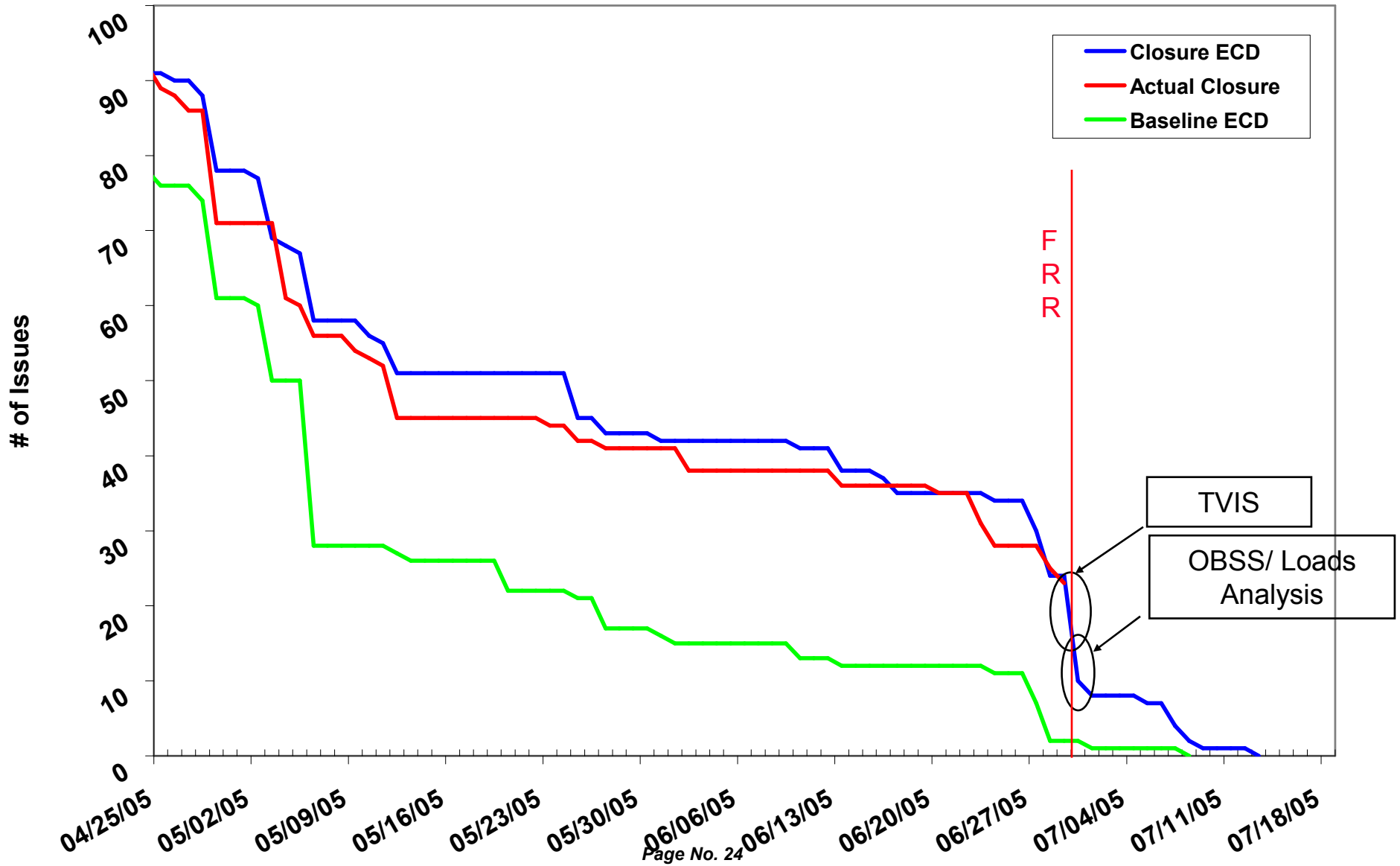
CoFR Exceptions – Items not meeting the CoFR endorsement

- **ELF1SORR-001 TPS (ECD 7/1/05)**
 - ◆ ISS-NCR-145 SRMS Lack of FT – ECD 7/1/05
 - ◆ ISS-MCH-0111-LF1 Inability to gain/maintain structural integrity (Dependant on closure of 145)
- **ELF1SORR-006 APAS ECD 7/7/05**
 - ◆ ISS-APAS-0110-AC ECD 7/7/10
 - ◆ NCR-ISS-155 ECD 7/7/10

Note: Post FRR & SORR nominal process opens and closes paper on a continuous basis (i.e. SPNs, FIARs, PRACAs, etc.) which will be worked with S&MA.



S&MA Open Paper Burndown With Baseline as of 06/28/05





SORR Open Paper (continued)



Safety

- **(4) Hazard Reports**

- ◆ APAS-0110-LF1 – ECD 7/7/05

- ♦ Pending closure of NCR-ISS-155

- ◆ EVA-0301-LF1 – EVA Collision using SAFER for contingency tile inspection issues ECD 7/1/05

- ♦ Pending closure of ORBI HR 348 and 349 – SSRP 6/16/05, SPCB

- ◆ MCH-0111-LF1 – Inability to gain/maintain structural integrity ECD 7/09/05

- ♦ Pending closure of associated NCRs 145 ECD 7/09/05

- ◆ ESP2-ESPAD-04 Gain/Maintain Structural Integrity Using Attachment Mechanisms ECD 7/13/05

- ♦ Pending Containment Analysis and ECD 7/13/05



SORR Open Paper (continued)



- **(3) NCRs**

- ◆ NCR-ISS-145 - SRMS Lack of FT – ECD 7/07/05

- ♦ Need additional data from Sonny White (ER3) (ECD 6/27/05)
- ♦ SRP(ECD 7/1/05), DSSR (ECD 7/6/05), JPRCB (ECD 7/7/05)

- ◆ NCR-ISS-155 – APAS Pyrotechnics – ECD 7/07/05

- ♦ SRP(ECD 6/28/05), DSSR (ECD 7/6/05), JPRCB (ECD 7/7/05)

- ◆ NCR-ISS-159 – Lack of Two Fault Tolerance for Shuttle docking – ECD 7/07/05

- ♦ SRP (ECD 6/28/05), DSSR (ECD 7/6/05), JPRCB (ECD 7/7/05)



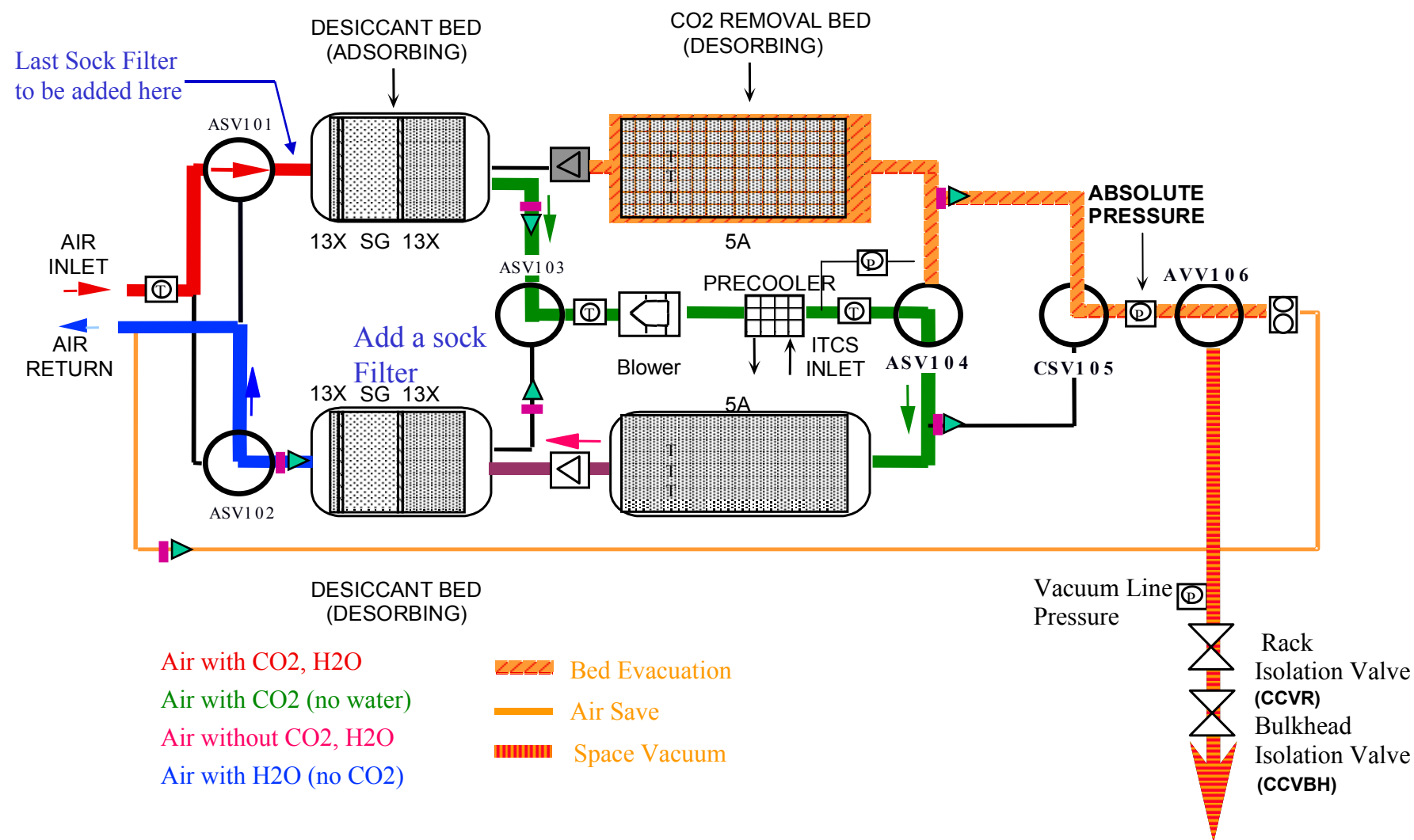
SORR Open Paper (continued)



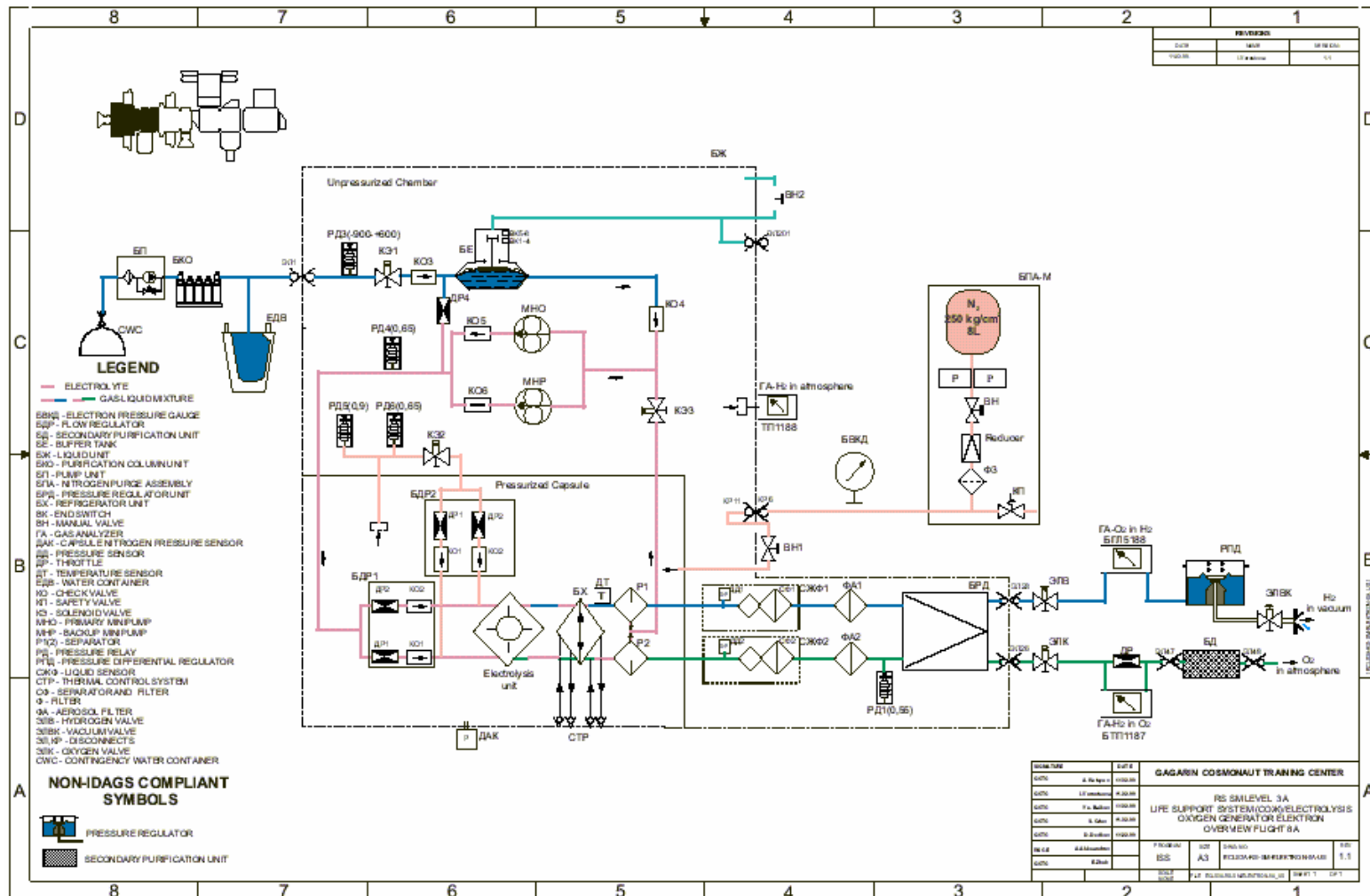
- **8 Safety VTLs tied to OBSS SSRMS Operations ECD 6/30/05**
- **8 Open Hardware Certifications**
 - ◆ Crew Care Package – ECD 07/08/05 (Launch Dependent)
 - ◆ 6 Items tied to TVIS – ECD 06/30/05
 - ◆ CSA-CP O2 Sensor– ECD 07/05/05

Back-Up

Carbon Dioxide Removal Assembly (CDRA) Status



Elektron Schematic



LF1 Detailed Summary report (as of 6/3/05)

6/3/05 Assumptions for CSCS Cases - LF-1 Launch 7/13/05									
Subsystem	ISS Failure at MECO	* Dual Failure Case	30 Days	Best Engineering Judgement - LF-1 (7/13/05)	56 Days	Max. (No Failures)	71 Days		
CO2	All Cases			ISS US LiOH: All cans expired by 4/29/05		ISS US LiOH: Expired LiOH unusable (all cans expired by			
	Assume same as Max case unless otherwise noted.			ISS Expired LiOH: 15 cans at 100%, 7 cans at 95%, and 8 cans at 50%		ISS Expired LiOH: 15 at 100%, 7 at 95%, and 8 at 50%			
	Min Cases			STS US LiOH: 31 cans from MD; 18 cans in MPLM		STS US LiOH: 31 cans from MD; 18 cans in MPLM			
	Case 1: Vozdukh Failed	144 Days		RS LiOH: 18 usable cans (on 2004 Progresses)		RS LiOH: 18 usable cans (on 2004 Progresses)			
	Case 2: CDRA Failed	30 Days		Vozdukh: 2 beds (3 crew/Day), 3 days maintenance		Vozdukh: 2 beds (3 crew/Day), 3 days maintenance			
	Case 3: CDRA Single Bed	144 Days		CDRA: Single bed (5 crew/day), 5 days maintenance		CDRA: 2 beds (8 crew/day)			
	* Case 4: No access to MPLM (CDRA spares, assume failed, and 18 US LiOH cans)	24 Days		CSCS Support with Shuttle Resources	102 Days				
	* Case 5: CDRA single bed, no Vozdukh	42 Days		CSCS Support with Immediate Shuttle Undock	10 Days				
				CSCS Support with No Access to MPLM	66 Days				
				CSCS Support at End of Launch Window (7/31/2005)	102 Days	Maximum CSCS Support	Unlimited		
O2	All Cases			Total ISS O2 at docking: 314.12 kg		Total ISS O2 at docking: 357.75 kg			
O2 Usage Rate: 0.8346 kg/person-Day	Assume same as Max case unless otherwise noted.			Old SFOGs: Available at 80 % reliability (Total on-board = 38; 30 available)		Old SFOGs: Available at 80 % reliability (Total on-board = 38; 30 available)			
	Min Cases			STS O2 Transfer: None		STS O2 Transfer: None			
1 SFOG = 1.84 lbs	Case 1: Elektron Failed.	56 Days		18P O2 Available at docking: 64.8 kg (34.6kg for 7/31 launch)		18P O2 Available at docking: 108.42 kg			
	Case 2: New SFOG cartridges unusable	73 Days		New SFOGs: 72, 32 launched on 17P, 40 launched on 18P		New SFOGs: 72, 32 launched on 17P, 40 launched on 18P.			
	Case 3: Loss of high pressure O2 A/L tank.	72 Days		Elektron: FAILED as of 6/03/2005		Elektron: ON for 3 crew.			
	Case 4: Loss of low pressure O2 A/L tank.	65 Days		A/L high pressure O2 tank: 65.32 kg		A/L high pressure O2 tank: 65.32 kg			
	* Case 5: Loss of both A/L O2 tanks.	55 Days		A/L low pressure O2 tank: 100.24 kg		A/L low pressure O2 tank: 100.24 kg			
	* Case 6: Elektron failed and no new SFOGs (could fail because new technology).	48 Days		CSCS Support with Shuttle Resources	56 Days				
	Case 7: Old SFOGs fail	80 Days		CSCS Support with Immediate Shuttle Undock	39 Days				
				CSCS Support at End of Launch Window (7/31/2005)	52 Days	Maximum CSCS Support	85 Days		
Water	All Cases - Qty available			Available Qty		Available Qty			
(usage rate changed based on which systems are operating)	Assume same as Max case unless otherwise noted.			Total ISS Qty at LF-1 launch: 654 L		Total ISS Qty at LF-1 launch: 654 L			
	Min Cases			Shuttle Transfer: 24 CWCs (1032 L)		Shuttle Transfer: 24 CWCs (1032 L)			
	Case 1: SRV-K failed at launch	73 Days		Unusable Leaky CWCs: 0 CWCs (0 L)		Unusable Leaky CWCs: 0 CWCs (0 L)			
	Case 2: Loss of CFU	83 Days		Condensate (Condensate Recovered: 457 L)		Condensate (Condensate Recovered: 394 L)			
	Case 3: Loss of 1 Rodnik tank (210 L)	73 Days		SRV-K: ON with consumables for 2 crew from 17P to 18P, plus 45 days skip cycle		SRV-K: ON with consumables for 2 crew from 17P to 18P, plus 45 day skip cycle			
	* Case 4: No STS transfer (non TPS failure)	43 Days		CFU: OFF due to current SRV-K/SKV anomalies		CFU: ON until SRV-K consumables run out			
	* Case 5: Loss of both Rodnik tanks (420 L)	66 Days		Condensate Collection: 54% / 46 (RS/US%)		Condensate Collection: 54% / 46 (RS/US%)			
	Case 6: 8 Leaky CWCs Unuseable	68 Days		Use condensate as flush water (0.3 L/person-Day)		Use condensate as flush water (0.3 L/person-Day)			
				Rates		Rates			
				Elektron on in 16Amp Mode during docked ops, 1.6 L/day		Elektron on in 16Amp Mode during docked ops, 1.6 L/day			
				Elektron on in 50Amp Mode during docked ops, 5 L/day		Elektron on in 50Amp Mode during docked ops, 5 L/day			
				ISS E10: 2.3 L/person-Day; E11: 2.3 L/prson-day		ISS E10: 2.3 L/person-Day; E11: 2.3 L/prson-day			
				STS crew drinks 0 L/person-Day extra for food rationing		STS crew drinks 0 L/person-Day extra for food rationing			
				CSCS Support with Shuttle Resources	83 Days				
				CSCS Support with Immediate Shuttle Undock	31 Days				
				CSCS Support with No Access to MPLM	43 Days				
				CSCS Support at End of Launch Window (7/31/2005)	78 Days	Maximum CSCS Support	81 Days		
Waste Management	All Cases			ASU:					
6 urinations/ person-Day	Because the waste management duration is strictly consumables based, this number is the same for all three durations. In case of ASU failure, nominal ASU			ISS Apollo Bags: 23 bags					
1.2 defecations/ person-day				STS Apollo Bags: 40 bags					
				ISS Male UCDs: 9 UCDs					
				ISS HRF Male UCDs: 63 UCDs					
				ISS Female UCDs: 40 UCDs					
				ISS HRF Female UCDs: 0 UCDs					
				STS Contingency Diapers: 24 diapers					
				EVA Contingency MAGs: 17 MAGs					
				CSCS Support with Shuttle Resources					
				Solid Waste Collection	71 Days				
				Urine Collection	72 Days				
				CSCS Support with Immediate Shuttle Undock					
				Solid Waste Collection	58 Days				
				Urine Collection	59 Days				
				CSCS Support with No Access to MPLM					
				Solid Waste Collection	61 Days				
				Urine Collection	72 Days				
Food	163.5 rations on orbit as of 6-5-05			Case 2: All 9 crew @ 2000 kcal/day (7.2 rations/day):		Case 3: 7 crew @ 1000 kcal/day;			
Calculations	+192 rations rations on 18P			Durations supported:	66 Days	2 crew at 2000 kcal/day (4.4 rations used/day):			
Performed by SF	+120 rations in the MPLM of LF1 (40 containers)			CSCS Support with Immediate Shuttle Undock	38 Days	Duration supported:	108 Days		
Vicky Kloeris	+ 84 rations in mid-deck of LF1 at dock			CSCS Support with No Access to MPLM	50 Days				
	-80 rations used 6/5/05-7/15/05								
	Total: 479 rations available at dock								
	Case 1: 7 crew at 2400 kcal/day (8.55 rations/day)								
	Duration supported	56 Days							